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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the Fishery Data Centre and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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Cover photo: Kasimedu Fishing Harbour at Madras

IMPACT OF MESH SIZE REDUCTION OF TRAWL NETS ON THE PRAWN FISHERY OF KAKINADA IN ANDHRA PRADESH*

Introduction

Kakinada is one of the important fish landing centres of Andhra Pradesh. Fishery resources from the coastal waters off this centre has been traditionally exploited by indigenous crafts and gears. Commercial trawling to tap the ground fishes and crustaceans was initiated in 1964. Since then there has been a steady increase over the years in the number of trawlers operating along this coast resulting in considerable expansion of the fishing industry. With the development of an export market for prawns from Kakinada after 1970 the sole aim of the trawler operation has been to harvest more and more prawns. This has eventually resulted in certain changes in the gear and crafts and the area of operation. One such change was in the mesh size of the cod ends of the trawl nets. The Central Marine Fisheries Research Institute has been undertaking routine monitoring studies on the prawn fisheries of this centre since 1967 and, of late especially from 1977 onwards it was noticed that relatively smaller prawns of the conventional species as well as adults of the tiny shrimp *Acetes* started appearing regularly in the trawl catches in considerable quantities. This has prompted an analysis of the prawn catches of the area in relation to the mesh sizes of the nets operated and the results are reported here.

Prawn fishery by trawl nets

Prawn fishing at Kakinada by trawl nets is carried out by small mechanised boats of sizes upto 12 m belonging to three categories namely Pablos (9 m), Pomfrets (10 m) and Sorrahs (12 m) based at the fishing harbour. The trawling ground lies between 5 m and 80 m depth outside Kakinada bay and extends upto a distance of about 50 km off the shore (Fig. 1). According to Muthu *et al (Indian J. Fish.* 2, 1975) the mesh size of the cod ends of the nets operated during 1967–70 was 25 mm, and the prawn catch consisted mostly of big prawns (11.9%) consisting of species like *Penaeus indicus* and *P. monodon* and medium sized prawns represented by *Metapenaeus affinis, M. monoceros, Parapenaeopsis stylifera* and *P. hardwickii* (60.5%). The rest of the catch was contributed by small prawns such as *M. dobsoni, Hippolysmata ensirostris, Palaemon tenuipes* and several other small sized penaeid prawns in comparatively small quantities. A change in pattern of the species composition was noticed from early 1977 onwards, coinciding with a noticeable change in the mesh sizes of the gears operated for catching prawns.

Change in mesh sizes

The present study involves two surveys on the cod end mesh sizes of commercial trawls, one in November 1977 and the other in August 1978. The frequency of the cod end mesh sizes recorded on these two occasions of successive years is shown in Table 1. During the first survey in 1977 a total number of 28 nets representing all the gears operated from the three types of boats were examined. The mesh size ranged from 10 mm to 20 mm at the cod end as compared to 25 mm in earlier years recorded by Muthu *et al* and 82% of the nets belonged to less than 18 mm mesh. In the second survey made in 1978, 37 nets were sampled and it was observed that still smaller sizes of mesh were also introduced into the fishery by that time, the range of mesh size being 8-20 mm. Out of this, more than 85% had meshes below 17 mm thereby indicating a gradual reduction in the cod end mesh size. The increasing catch trend in these years would show that this decrease in cod end mesh size has been evidently introduced by the fishermen for getting improved catches.

Effect of mesh size reduction on prawn fishery

It is generally believed that reduction of mesh sizes in commercial gears may lead to harvesting of juvenile populations and consequent decrease in sizes of species caught coupled with probable depletion of the stocks of exploited species. In order to verify this, an analysis of the data collected during 1967–1979 on catch, effort, catch rate (catch per hour) and species composition has been made and the results are shown

*Prepared by G. Sudhakara Rao, C. Suseelan and S. Lalitha Devi.

Table 1. *Frequency of cod end mesh size of trawl nets observed in November 1977 and August 1978 at Kakinada*

Cod end mesh size in mm	NOVEMBER 1977 No. of nets	Percentage	AUGUST 1978 No. of nets	Percentage
8	—	—	1	2.70
9	—	—	2	5.41
10	2	7.14	3	8.11
11	2	7.14	3	8.11
12	5	17.87	6	16.22
13	2	7.14	4	10.81
14	2	7.14	3	8.11
15	3	10.71	5	13.50
16	3	10.71	4	10.81
17	4	14.30	2	5.41
18	2	7.14	2	5.41
19	—	—	1	2.70
20	3	10.71	1	2.70
Total No. of nets examined	28	100.00	37	100.00

in Tables 2, 3 and 4. Besides catch and effort details an attempt is also made to analyse the length distribution of important species which determine the success of the trawl fishery of this coast.

Variations in prawn production

As could be seen from Table 2, the prawn catches showed more or less a steady increasing trend till 1977 and thereafter reduced, although remaining at high range when compared to years earlier to 1975. The catch per hour of trawling, however, exhibited many ups and downs over the years. The thirteen year period can be divided into 4 stages in the development of the prawn fishery along this coast. In the first stage, during the years 1967–69, there was not much emphasis on catching prawns as the price for prawns was very low when compared to the subsequent years. The boats covered only the nearby fishing grounds and the cod end mesh size was 25 mm as pointed out earlier. The catch per hour (C.P.H) was also more or less stable. The decline in effort and prawn catch during 1969 was mainly due to the migration of some trawlers to Visakhapatnam harbour.

In the second stage, during the years 1970–72, export trade gradually developed and the price of the

Table 2. *Prawn landings by trawlers at Kakinada during* 1967–1979, *with details on catch/hour and percentage composition of penaeids, non-penaeids and Acetes spp. (Landings in tonnes and C. P. H. in Kg)*

Years	Penaeids			Non-penaeids excluding *Acetes*			*Acetes* spp.			Total prawns		Effort of trawling (in hours)
	Catch	C.P.H.	%	Catch	C.P.H.	%	Catch	C.P.H.	%	Catch	C.P.H.	
1967	119	5.9	90.2	13	0.64	9.8	—	—	—	132	6.6	20183
1968	317	7.5	93.2	23	0.54	6.4	—	—	—	340	8.0	42454
1969	245	7.2	91.4	23	0.67	8.6	—	—	—	268	7.9	34155
1970	369	9.8	91.6	34	0.91	8.4	—	—	—	403	10.7	37701
1971	560	10.0	92.9	43	0.77	7.1	—	—	—	603	10.8	55854
1972	839	12.4	96.9	27	0.40	3.1	—	—	—	866	12.8	67628
1973	791	5.9	96.2	31	0.23	3.8	—	—	—	822	6.1	134119
1974	1380	7.8	96.4	51	0.29	3.6	—	—	—	1432	8.1	176929
1975	1455	7.8	89.5	170	0.91	10.5	—	—	—	1625	8.7	187065
1976	2308	9.7	95.1	120	0.51	4.9	—	—	—	2428	10.2	237333
1977	2771	6.7	44.8	1882	4.54	30.4	1538	3.71	24.8	6191	14.9	414697
1978	1326	3.7	64.5	409	1.13	19.9	321	0.89	15.6	2056	5.7	361470
1979	1651	4.7	68.9	406	1.16	16.9	339	0.97	14.1	2396	6.8	349738

Table 3. *Annual landings in tonnes of different species of prawns by trawlers at Kakinada during* 1967—1979

Species	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
M. monoceros	20	83	46	61	73	118	138	486	222	168	432	194	213
M. affinis	37	69	50	42	56	78	62	83	245	100	82	100	121
M. dobsoni	4	42	66	139	195	319	323	325	317	1257	1482	382	247
M. brevicornis	12	35	17	28	86	107	98	128	105	169	185	164	100
P. monodon	17	22	20	39	25	60	41	92	151	101	64	119	89
P. indicus	15	13	15	25	27	91	42	88	94	108	238	59	109
P. merguiensis	4	1	2	1	2	5	4	9	12	18	27	20	53
P. stylifera	2	15	9	9	35	21	19	52	69	78	30	47	143
P. hardwickii	2	5	5	9	17	—	7	23	30	52	12	28	80
S. crassicornis	3	21	7	8	26	12	29	36	38	65	92	59	85
Other penaeids	4	12	12	8	18	27	25	59	171	192	126	154	411
Non-penaeids excluding *Acetes*	13	23	23	34	43	27	31	51	170	120	1881	409	406
Acetes spp	—	—	—	—	—	—	—	—	—	—	1538	321	339

Table 4. *Annual percentage composition of different species in the trawler prawn landings at Kakinada during 1967—1979*

Species	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
M. monoceros	15.4	24.0	17.1	15.0	12.1	13.6	16.8	33.9	13.7	6.9	7.0	9.4	8.9
M. affinis	27.9	20.0	18.5	10.4	9.3	9.0	7.6	5.8	15.1	4.1	1.3	4.9	5.0
M. dobsoni	2.9	12.1	24.7	34.6	32.4	36.9	39.3	22.7	19.5	51.8	23.9	18.6	10.3
M. brevicornis	8.9	10.2	6.4	6.9	14.2	12.3	12.0	9.0	6.5	7.0	3.0	8.0	4.2
P. monodon	12.5	6.4	7.3	9.6	4.0	7.0	5.0	6.4	9.3	4.2	1.0	5.8	3.7
P. indicus	11.7	3.9	5.4	6.3	4.5	10.5	5.1	6.2	5.8	4.4	3.8	2.9	4.5
P. merguiensis	2.9	0.1	0.8	0.1	0.3	0.6	0.5	0.6	0.8	0.7	0.4	1.0	2.2
P. stylifera	1.5	4.3	3.2	2.4	5.8	2.5	2.4	3.6	4.3	3.2	0.5	2.3	6.0
P. hardwickii	1.5	1.5	1.9	2.3	2.8	—	0.9	1.6	1.9	2.1	0.2	1.4	3.3
S. crassicornis	2.5	6.1	2.6	2.0	4.4	1.4	3.5	2.5	2.3	2.7	1.5	2.9	3.6
Other penaeids	2.9	5.4	3.6	2.0	3.0	3.2	3.1	4.1	10.5	7.9	2.0	7.5	17.2
Non-penaeids excluding *Acetes*	9.4	6.0	8.5	8.4	7.1	3.1	3.8	3.6	10.4	4.9	30.4	20.0	17.0
Acetes spp.	—	—	—	—	—	—	—	—	—	—	24.8	15.6	14.1

prawns went up sharply. Simultaneously changes in the craft and gear also occurred to catch more and more prawns. As a result of these changes in the fishing implements and consequent increase in the efficiency of nets to harvest prawns, the prawn landings as well as C.P.H. increased during this period. The cod end mesh sizes of most of the nets were reduced to 20 mm by this time.

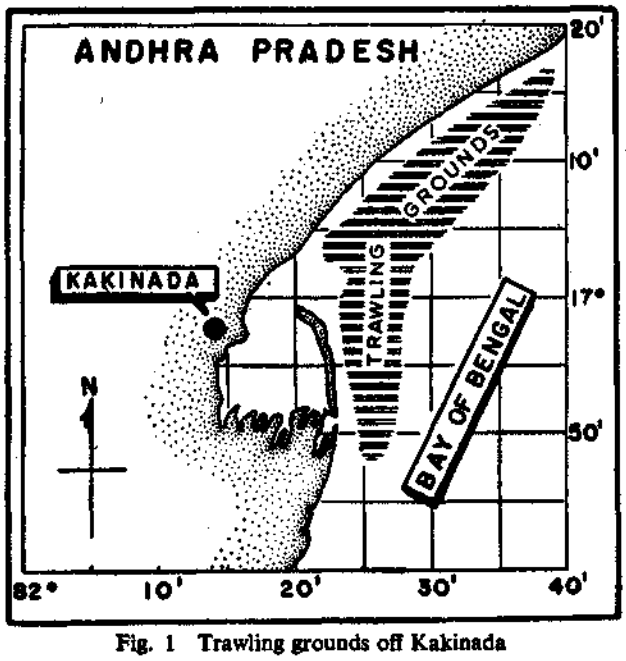


Fig. 1 Trawling grounds off Kakinada

In the third stage, during 1973–76, the effort has increased enormously with entry of new boats into the fishery. In 1973 a decrease in the prawn landings was observed inspite of the two-fold increase in the effort. Probably this was the first sign of depletion of the prawn stocks hitherto exploited by the trawlers. To overcome this situation many of the trawlers were forced to venture distant grounds. By 1976, the trawlers started combing along this coast covering about 100 km of the coast line upto 80 m depth. This dispersed effort over a wider area was responsible for the steady increase of prawn landings and C.P.H. during this period. Modification in the gear, however, was negligible as the main aim was to catch bigger sized prawns which fetch premium price.

In the fourth stage, during 1977–79, the effort has reached a saturation point. As the boats are small and cannot operate beyond a reasonable distance from the shore the only alternative for the fishermen to get better prawn catch was to reduce the mesh size of the cod end to less than 20 mm (Table 1). By this time the exporters started purchasing smaller species like *M. dobsoni* also for export purpose. As a result of this mesh size reduction and enormous increase in fishing effort the prawn landings touched a record level of 6,191 tonnes in 1977. This was mainly due to the heavy catches of non-penaeid prawns and the entry of *Acetes* into the fishery in large quantities. The increase in penaeid catch was only marginal (463 t). The C.P.H. for penaeids was low in 1977 when compared to the previous three years. In the following years, 1978 and 1979, the total production as well as catch rate of prawns were relatively low although the trawling effort expended was about 50% more than in 1976 and the nets with reduced cod end mesh sizes continued operations. This may indicate that the fishery has already crossed the level of optimum production and the decline after 1977 was probably the result of diminishing returns due to overfishing.

Change in species composition

Data on species composition for the different years (Tables 3 and 4) would indicate that penaeid prawns formed the bulk of the fishery contributing

more than 90% till 1976 and most of the major species have shown more or less a steady increasing trend of production. But in the subsequent years the non-penaeid prawns which are generally smaller in size than the penaeids, contributed to the catches in greater proportions in as much as relegating penaeid prawns into a secondary position in 1977. The important species are *Acetes* spp. *Palaemon tenuipes* and *Hippolysmata ensirostris*. The most significant change occurring during this period was the entry of the sergestid prawns *Acetes* spp. into the fishery to the extent of forming 14–30%. These tiny shrimps, although available in abundance in the sea as well as backwater areas of this centre and caught regularly in the indigenous gears, have never been encountered before in the trawl catches supporting a fishery. Their entry into the trawl fishery in large quantities along with other non-penaeid prawns of smaller sizes in 1977 coincides with the reduction in mesh sizes of the nets, indicating thereby that this change is brought about by the reduction in mesh size.

Change in sizes of prawns

Examination of the annual length frequency data indicates that in the penaeid prawns like *M. dobsoni* the major size group contributing to the fishery decreased from 81–100 mm in 1972 to 71–80 mm by 1978–79 period (Fig. 2). The mean size of the females of this species showed a decreasing trend from 1972 to 1978, while in males the decrease began from 1975 and continued till 1978 (Table 5). The percentage of prawns measuring less than 60 mm total length shown in the same table was also relatively high during 1977–78 than in the previous years.

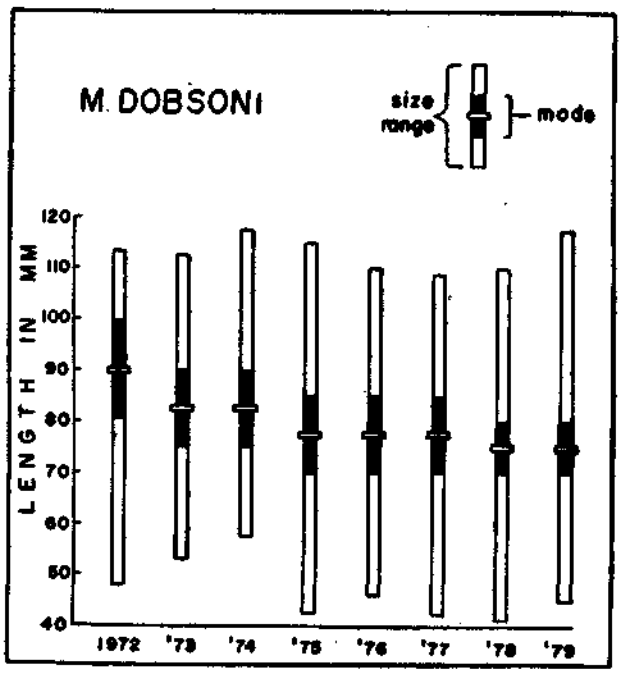


Fig. 2 Annual size distribution of *Metapenaeus dobsoni* in the trawl catches at Kakinada during 1972–79

Table 5. *Annual mean sizes and percentage composition of prawns below 60 mm total length of M. dobsoni during* 1972–78

Year	Females		Males	
	Mean size in mm	% of prawns below 60 mm total length	Mean size in mm	% of prawns below 60 mm total length
1972	88.49	2.82	79.14	3.19
1973	87.25	1.69	75.50	3.18
1974	84.94	—	80.08	1.47
1975	82.88	4.25	77.89	4.76
1976	82.36	1.74	73.71	3.71
1977	82.24	4.47	73.76	8.38
1978	78.41	10.93	69.28	17.98

In the case of another important penaeid species *M. monoceros* the major sizes in the trawl fishery were within 111–150 mm total length during 1972–76 with minor variations between years (Fig. 3). But, from 1977 onwards the size began to decline and reached 81–90 mm by 1978. A gradual decrease in the annual mean sizes was also noticed in recent years (Table 6).

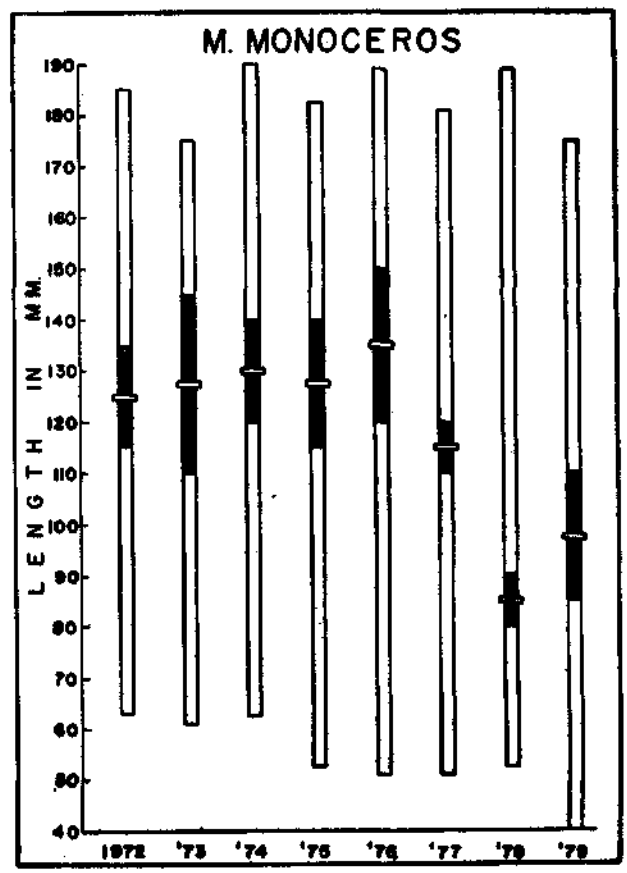


Fig. 3 Annual size distribution of *Metapenaeus monoceros* in the trawl catches at Kakinada during 1972–79

Table 6. *Annual mean sizes and percentage composition of prawns below 100 mm total length of M. monoceros during 1972–78*

Year	Females		Males	
	Mean size in mm	% of prawns below 100 mm total length	Mean size in mm	% of prawns below 100 mm total length
1972	118.77	25.63	105.29	38.71
1973	114.02	38.05	100.00	43.20
1974	122.23	25.18	111.69	25.64
1975	123.56	16.94	111.72	19.15
1976	122.30	25.88	107.44	37.24
1977	114.60	30.69	102.53	40.33
1978	114.96	40.85	102.07	50.55

All these are clear-cut evidences to suggest that a population consisting of smaller sizes of prawns are being exploited in recent years. Here it is necessary to know whether this situation has arisen due to mesh size reduction or not. In order to verify this, the length frequency distribution of *M. dobsoni* caught in cod ends of 20, 15 and 10 mm mesh sizes has been analysed and the results depicted in Fig. 4. It is seen that catchability of smaller prawns is more in trawl nets with 10 mm and 15 mm cod end meshes. This clearly proves that reduction of mesh size is responsible for catching more numbers of smaller prawns.

In addition the entry of smaller sized shrimps and non-penaeid prawns like *Acetes* spp. *P., tenuipes* and *H. ensirostris* at the time of mesh size reduction of the nets also points towards the fact that size reduction of prawns is brought about by mesh size decrease.

Conclusion

From the analysis it is clear that the prawn fishery from 1977 onwards shows a difference from that of the earlier years in respect of prawn production and catch rate, species composition and sizes of the constituent species. During these years no changes were observed in the depths or area of fishing operations, length of fishing trips or any other characteristic of the fishery in general, except for the conspicuous reduction in cod end mesh sizes of the nets used and noticeable increase in input of effort. Therefore it would appear that these two factors are responsible for the present state of the fishery in this area.

The decrease in total catch of prawns as well as catch rate is probably brought about by the increase in fishing effort. Although the decrease in size of important species of penaeid prawns might have been partly due to the increase in effort, the situation in this area involving reduction of cod end mesh sizes

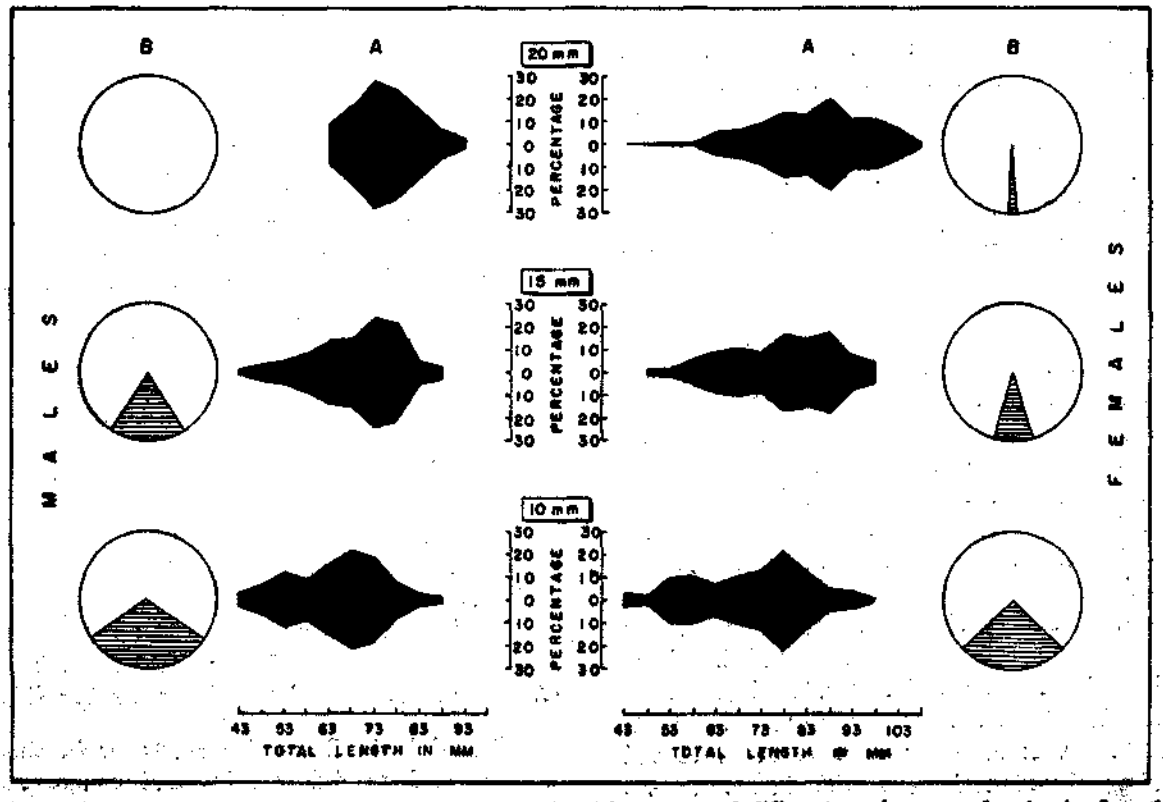


Fig. 4 Length frequency distribution of *Metapenaeus dobsoni* from nets of different mesh size cod ends. A – Length distribution, B – Percentage of prawns measuring less than 60 mm size.

of the trawl nets points to the fact that the latter may be the main reason for change in sizes. The occurrence of smaller sized prawns like *Acetes* spp. which are never found in trawl nets with bigger size cod end mesh would definitely establish this fact. However, the drastic reduction in the catch rate of prawns in recent years along with the phenomenal increase in effort and simultaneous deterioration of sizes of exportable varieties of prawns in this area would need careful watching of the situation from the point of view of conservation of the resources.

The important point which emerges from the present analysis is the entry of *Acetes* and other small non-penaeid prawns into the trawl fishery as a result of mesh size reduction. It is also clear that large quantities of these shrimps are caught by the trawl nets with smaller mesh sizes. From a management approach if a reversion of the cod end mesh sizes of the nets to the larger sizes prevalent prior to 1977 and a prohibition of the operation of smaller mesh nets is recommended in order to increase production of large sized prawns, probably the smaller sized species like *Acetes* which are now represented in huge quantities may be lost to the fishery. Taking into consideration the value of the tiny shrimps from the point of view of utilisation a decision may have to be taken about regulation in the mesh sizes in the trawl fishery.

Editor: In view of the fact that the new resources of the tiny shrimp *Acetes* spp. has come into the fishery as a result of the reduction in cod end mesh sizes of the trawl nets, with the restoration of the mesh to the pre-1977 sizes in order to prevent catching smaller sized prawns, an alternate method of exploitation of the resources of the smaller shrimps may have to be developed. As these shrimps mostly occupy the column, experimental fishing with midwater trawls of small mesh sizes will be useful in exploiting the resource.

DOLPHIN FISHES*

Dolphins are the true mammals of the seas. But this name finds a convenient place among fishes too when the fishes belonging to the family, Coryphaenidae are popularly termed dolphin fishes. Not only these mammals and fishes live in the same area but also have a similarity in shape and in the habit of jumping above water, persumably sufficient reasons for assigning such a name to these fishes.

The 'dolphins' or the dolphin fishes as they are called by some authors are larger pelagic species of the high seas living in tropical and temperate waters. These fishes possess the combination of various unique characters viz., extension of dorsal fin from nape almost to caudal fin, origin of anal fin from mid-ventral point of body and extending to caudal without spiny rays and the different nature of colouration in juvenile, middle-aged and fully formed specimens. Adult male fishes have a squarish head with a bony crust whereas in females the head is somewhat rounded. These combination of characters probably induced the earlier workers to identify several species in the family. It was found later that the bony crust on the head and corresponding elevation develop with increasing age giving a totally different shape at various stages. Hence Weber and Beaufort (1931. *Fishes of the Indo-Australian Archipelago,*VI, *Leiden)* established a single species in this family viz., *Coryphaena hippurus* from the Indo-Australian Archipelago. Later, one more species, *Coryphaena equiselis* was described under Coryphaenidae from the eastern Indian ocean and western central Pacific (Fischer, W and P.J.P. Whitehead 1974. *Species identification sheets for fishery purposes, F.A.O., Rome).* But along the Persian Gulf region the presence of only *C. hippurus* has been reported.

The common dolphin fish, *C. hippurus* Linnaeus (Fig. 1) attains a maximum of 2 m in length with an average of 90–100 cm. *C. equiselis* Linnaeus (Fig. 2) otherwise called 'pampano dolphin' is a smaller variety with a maximum length of 75 cm., the commercial size being 30–50 cm. Except for the size and the difference in the number of rays in the dorsal fin, this species is not distinguishable from the other. *C. equiselis* possesses 48-55 fin rays in the dorsal fin, whereas *C. hippurus* accounts for a higher number viz., 55–65.

The dolphin fishes live singly or in shoals and are reported to follow ships and congregate below

*Prepared by P. K. Mahadevan Pillai.

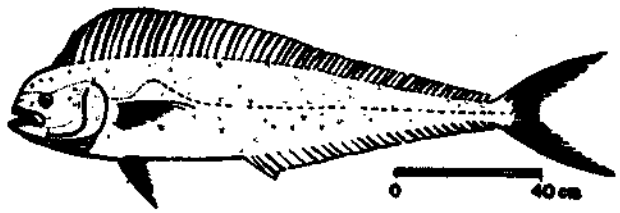


Fig. 1 *Coryphaena hippurus* Linnaeus

floating objects. They are fast swimmers attaining a speed of upto 56 km per hour. Detailed investigations on the biological characteristics of these species appear to be scanty. They are highly carnivorous with voracious feeding habits, mainly feeding on flying fishes. Besides flying fishes they also feed on sardines, anchovies, crustaceans and squids. More than 30 species of fishes belonging to 19 families were reported to have been taken from the stomach of dolphin fishes (Maurice and Robert Burton 1975. *Encyclopaedia of fishes, American Museum of Natural History).*

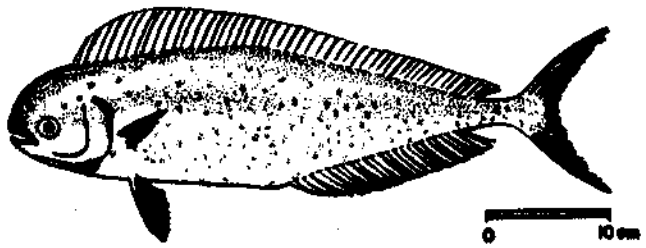


Fig. 2 *Coryphaena equiselis* Linnaeus

An interesting instance of behaviour pattern of juvenile dolphin fishes was noted by Dr. Earl S. Herald, the noted American icthyologist. He collected many small fishes swimming around a ship lying off Philippines attracted by light during night. On examination these were found to be the very young 'pampano dolphins'. On persuing the subject he observed that very few of the common dolphin fish came to the light but were seen swimming in the same place during the day time.

The dolphin fishes breed in the coastal waters as the water temperature rises. The growth of young fishes are very rapid as observed in the case of 52 captive dolphin fishes at the Marine Aquarium, Florida where juveniles with a length of 45 cm weighing 670 g were grown to size of 125 cm in length and weight of 16.7 kg within a period of seven months. It is believed that life span is short perhaps three years only. These fishes are excellent table fishes and are marketed mostly in fresh conditions.

The trend of dolphin fish landings along the Indian coast during the period, 1969–'78 show considerable fluctuations (Fig. 3). Of an estimated average catch of 225 tonnes of dolphin fishes, Andhra Pradesh contributed the maximum followed by Tamilnadu and Kerala.

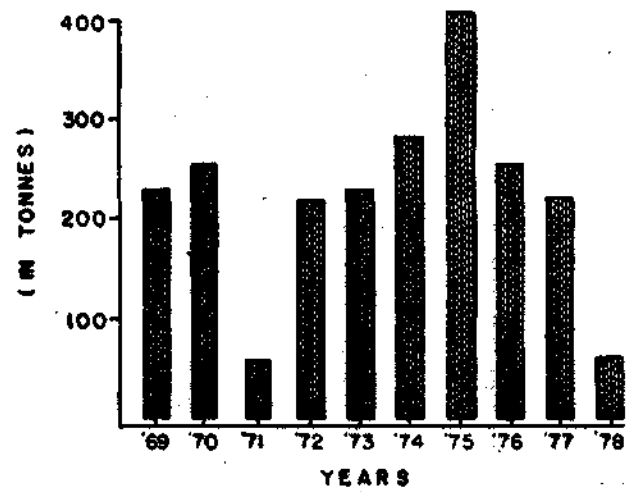


Fig. 3 Annual landings of dolphin fishes in India from 1969 to 1978

Though predominantly caught by trolling lines, they are also landed by purse-seiners and floating traps in some countries. In India they are caught mainly by hooks and lines and gill nets along the inshore waters. There is considerable scope to increase the catch of dolphin fishes by increasing the present level of exploitation.

ALL INDIA CENSUS IN THE MARINE FISHERIES SECTOR- PLANNING AND FIELD OPERATIONS*

The information base on the potentialities of man power involvement, the number of fishing crafts and gears and infrastructure facilities such as fishing harbours, landing jetties, ice plants and cold storage-cum-freezing plants available in the coast of India is a pre-requisite for planning developmental programmes in marine fisheries. This also provides the frame for conducting sample survey for the estimation of marine fish production and fishing effort in India. In order to understand the status of the traditional small scale fisheries sector in the changing pattern of fishing industry, periodic frame surveys for estimation of these parameters are vital. Keeping these in view the Institute has been conducting frame surveys at regular intervals ever since 1948–49.

Besides, the National Commission on Agriculture has emphasised in its recommendation that Central Marine Fisheries Research Institute should conduct quinquennial census in order to update the inventory of fishing resources available in the coastal villages with the help of State Governments. This gave a fillip for the Institute to undertake a rapid and intensive census on a massive scale during May–July 1980.

The planning for the conduct of the census was carried out much in advance. The various proformae in different languages required for recording the primary data were prepared and finalised in consultation with State Governments. The major items covered in the house-hold schedule were family size, educational status, number of active fishermen, number engaged in associated fishing activities, number of mechanised and non mechanised fishing crafts, number of fishing gears, type of ownership and number of fishermen engaged in aqua-culture practices. In the village schedule, information on fishing harbours, landing jetties, transport facilities and number of boat building and repairing yards, cold storages, freezing plants, fish curing yards, peeling sheds, banks, co-operative societies, educational institutions, hospitals, post offices etc. was included. The house-hold schedules to be filled in with the help of local persons engaged for the purpose were printed both in English and the regional languages of the maritime states, namely Oriya, Telugu, Tamil, Malayalam, Kannada, Marathi and Gujarathi. Suitable publicity materials in the form of attractive folders and wall posters in respective regional languages were also prepared (Fig. 1 & 2).

The Institute's personnel from the different divisions required to organise and supervise the census work in various states were identified sufficiently early. Each person put in charge of the work in 12 to 15 villages was to select, train and guide the local helpers engaged in the collection of census data. Senior staff of the Institute were placed in overall supervision of the work in different states. Orientation training to the staff was given at Contai, Cuttack, Waltair, Madras, Mandapam Camp, Cochin, Karwar, and Veraval. Wide publicity was given through the press, Akashvani and Doordarshan well before the commencement of the census.

The census work was carried out in the maritime states of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Pondicherry, Kerala, Karnataka, Goa, Daman, Diu and Gujarat during May–July 1980. About 2,000 marine fishing villages were covered and information collected as per the village and household schedules. In spite of the strenuous field work involved in covering difficult terrain and inaccessible villages it was possible to complete the collection of census data in two phases each covering a period of about one month with the whole-hearted co-operation received from the villagers, those connected with the fishing industry and officials of the State Governments.

The voluminous data collected are being processed. The statewise information on the current status of the manpower resources and infrastructure facilities involved in the marine fisheries sector of the country would be made available in published form as soon as possible.

*Prepared by Fishery Resources Assessment Division.

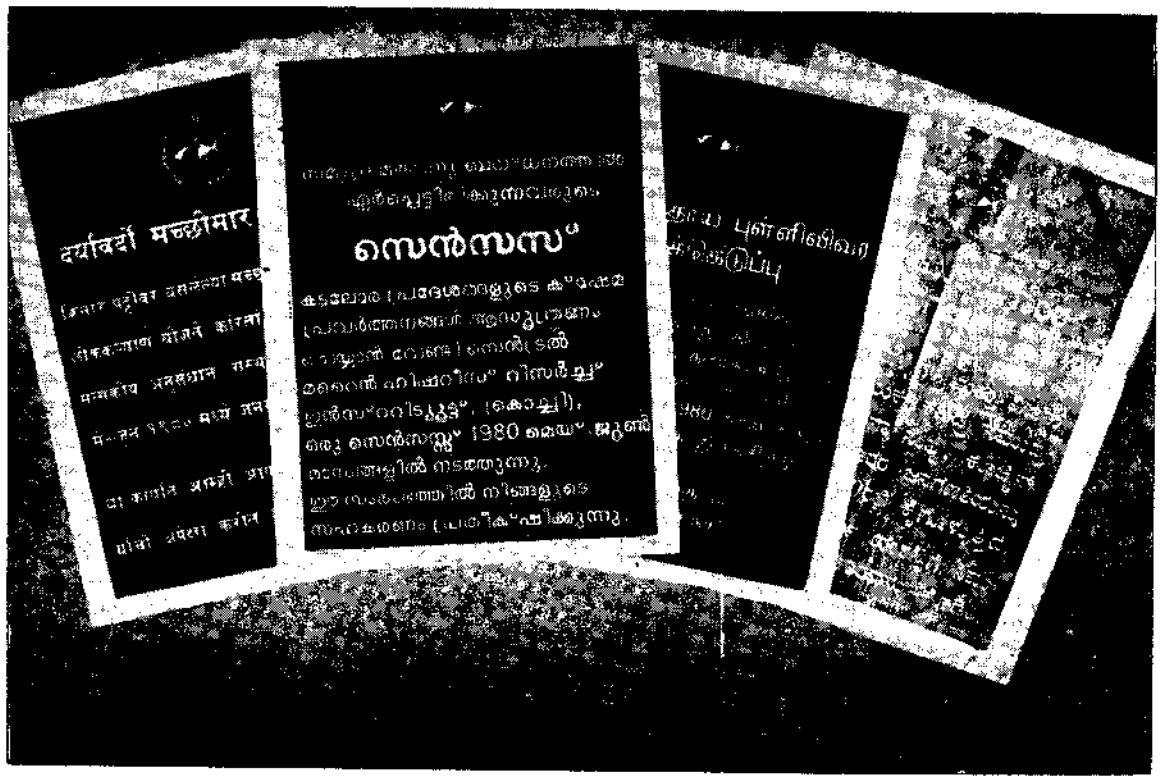


Fig. 1 Publicity wall posters in different languages

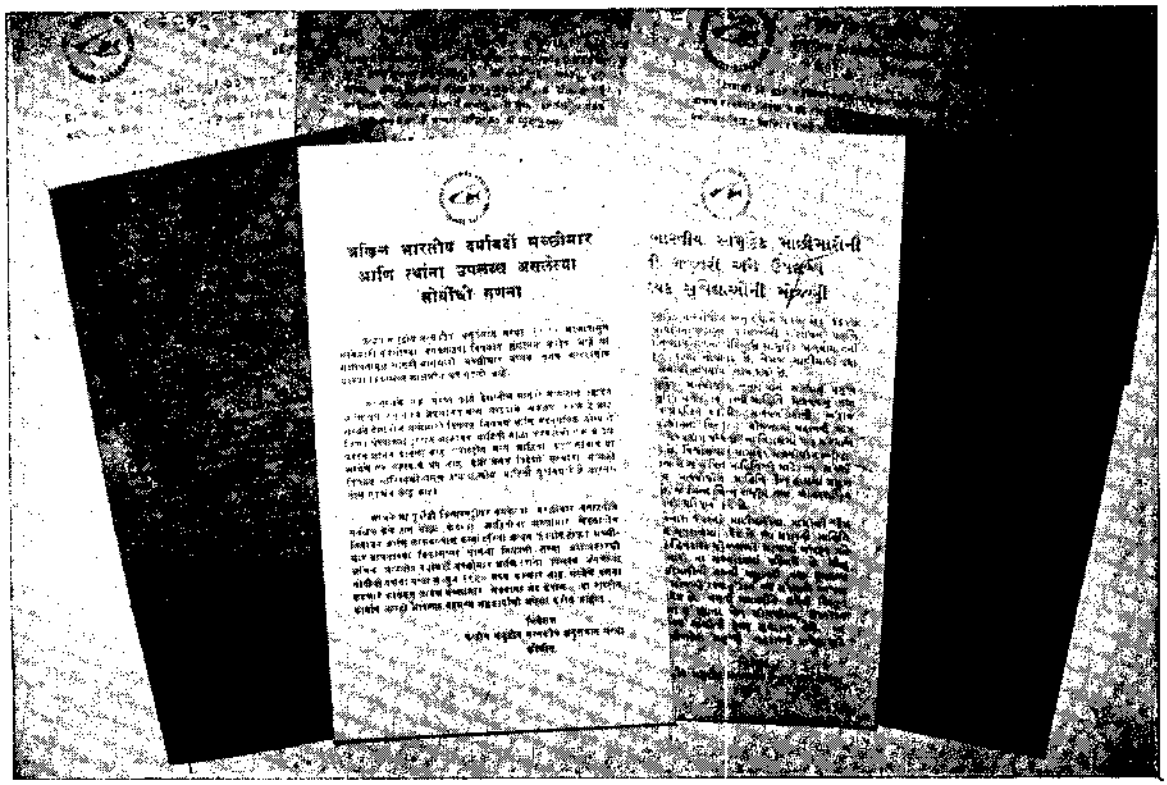


Fig. 2 Hand outs used in various languages

Fig. 3 Planning the strategy for the census in Tamil Nadu.

Fig. 4 All set for the days work

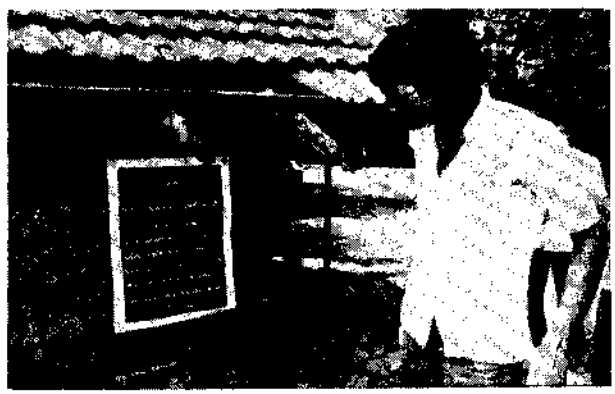


Fig. 5 Publicity poster in position in one of the villages

Fig. 6 Enumerating staff at the job

Fig. 7 Enumerating staff at work in a village in Gujarat

Fig. 8 Staff collecting information about freezing plant.

NEWS—INDIA AND OVERSEAS

Mariculture courses commenced in Central Marine Fisheries Research Institute

A Centre of Advanced Studies in Mariculture was established at the Central Marine Fisheries Research Institute in June 1979 under the ICAR/UNDP Project entitled "Centre of Advanced Studies for Post-graduate Agriculture Education and Research". The various mariculture research activities carried out at the Institute are being strengthened and intensified under this Centre. A programme for post-graduate education in mariculture in order to meet the requirement of research, technological and managerial personnel for the accelerated development of the field was also initiated at the Centre. Four Senior Research Scholars admitted to Ph. D. programme of the Centre in July 1980, have commenced work on identified priority areas of mariculture. It is also proposed to start a M. Sc. course of 2 years duration on mariculture which involves multidisciplines and to admit 10 students in this course for 1980–82 shortly. Preliminary arrangements for the admission of students are progressing.

Wreck fishing by Danish fishermen

Danish gill net fishermen have perfected the art of shooting their nets over sunken wrecks to harvest fish which inhabit them. The Danes have developed the difficult technique of fishing over wrecks into such a profitable method that they are now landing increasing number of their catches of big cod at Grimsby on the east coast of England. Most of the Danish gill netters landing at Grimsby are from Hvide Sande, Denmark's premier gill net port, which has more than 50 such vessels between 12 and 23 m long. The vessel has an aperture at the port side through which the nets are shot and a larger one on the starboard side for hauling.

It is reported that as many as 1,000 gill nets are carried every trip. They are shot in fleets of five or so, the actual number of fleets laid over and around a particular wreck depending on the size of the same. The nets measure about 1,000 meshes long by 20 meshes deep and for invisibility in the water are made from green coloured multifilament. Small plastic floats are mounted on the headline with 8 inch diameter galvanised steel rings on the foot rope. The netting is hung on the headline at about 50 per cent to form deep folds. In this way if the fish do not become fully gilled, they will almost certainly become entangled as they thrash from side to side to free themselves. Although wreck fishing may seem to be simple, the skipper has to exercise considerable skill in the use of his sonar to find wrecks and to help in shooting and hauling the nets. Net damage accounts for much of the cost of wreck fishing.

Very few British vessels have taken to wreck fishing. But in these days of mounting fuel costs, as a low-cost method wreck fishing is bound to attract many more boats, although the work is extremely arduous. While the Danish fishermen are exploiting the thousands of wrecks littering the botttom of the North Sea, off the United States the government is deliberately sinking ships to provide similar service for the fishermen.

FNI 19 (3): March 1980

New method for preservation of fish

Norwegian research workers claim to have developed a new method of preserving fish in which bactetia is used for the preservation. Their method is to use lactic acid bacteria in the same way that a cabbage is pickled and cream is converted to heavy sour cream.

The method has been tried on fish in Norway and found to simplify storage. It also avoids the use of chemicals suspected of being carcinogenic. Fodder mixtures treated with this method are reported to keep for a long time. Lactic acid is also well-suited for the preservation of minced fish. Further information can be obtained from Professor Raa, Institute of Fishery Technology Research, 9000 Tromso, Norway.

FNI 19 (3): March 1980

Sea urchin roe in demand

Japanese gourmets are looking for sea urchin roe from British Columbia. During the winter of 1978–79 nearly 75,000 kg of whole sea urchins were harvested and in 1979–80 the harvest was slightly better. The roes which represent about 10 per cent of the body weight are immediately removed and flown to Japan in ½ kg wooden trays. Only one of three species is harvested, the red urchin, which is the largest and most abundant. It is taken by skin divers.

FNI 19 (3): March 1980

California red algae study

Red algae, perhaps one of the first forms of life on earth, will be studied as a potential source of chemicals

useful in medical research and treatment under a 3 million dollar NOAA grant. The grant was awarded to the interdisciplinary California Sea Grant College Programme and will be matched by additional funds from state and private sources.

Previous California studies have shown that chemical substances isolated from various species of red algae have potential for use as insecticides and in the treatment of herpes simplex infections in humans. Further research will enable isolation and characterisation of active substances in algae, as well as evaluation of the behaviour, genetic potential and methods for growing algae in aquaculture systems.

Aquaculture Magazine 6 (1): Nov./Dec. 1979

Squids reported plenty in waters off Norway

The Institute of Marine Research after completing an expedition in the vessel *Michael Sars* reported that the sea is full of squids along the Norwegian coast. According to the report 50,000 tonnes could be taken without any trouble. The expedition ran into squids all along the coast of Norway. Sometimes squids chasing the mackerel filled up purse seines.

There is no problem in catching the squids. But the bottleneck is the infrastructure facilities for reception on land. Today most of the squids exported from Norway goes to Japan. But Canadian squids are preferred for bait, because they are smaller and can go directly into the baiting machines.

FNI 18 (12): December 1979

Self-polishing copolymer paints for fishing vessels

In the movement of a ship in the sea about four-fifths of the total ship resistance is due to friction and one-fifths only due to wavemaking. This means that as a ship becomes rougher her speed goes down and consequently her fuel consumption rises. One answer to this problem, introduced several years ago, is to use a paint which polishes itself as it progresses through the water, so that as surface roughness decrease the ship moves faster, thereby using lesser fuel.

Considerable experience with the self-polishing Copolymer (SPC) paint used in big vessels like large supertankers led to positive savings on fuel bills. It was thought that ships had to be moving fast to get maximum benefit and thus these paints, would not be of much use for slow moving vessels used for trawling and other fishing activities. But later experience showed that even moderate water flow was effective in polishing the paint and thus useful for fishing fleets also. In addition to SPC produced by International Marine Coatings (IMC) another product Takata LLL produced by Japan's Nippon Oil and Fats has also came into the market. The fishing fleets of several countries like Bulgaria, France and Cuba have taken to the use of these paints.

FNI 19 (3): March 1980

BOOKS

Harpooned By Bill spence. Conway Maritime Press, Greenwich, London, pp. 200, 1979.

Over the years attitudes about whaling have changed. Many people now regard whaling as immoral and unnecessary. But there was a time when it was admired as the respected calling of brave and adventurous men. In fact whaling inspired the finest novel ever written about the sea. This story of the enduring saga of the sea and of the brave men who lived from it and on it is well told by Bill Spence in this latest addition to the books on whaling.

Splendidly illustrated with over 200 pictures, *Harpooned* traces the history from 17th century and describes the most spectacular of the whaling periods. Today, the whale is threatened with extinction and, although the species may survive the whale hunters,

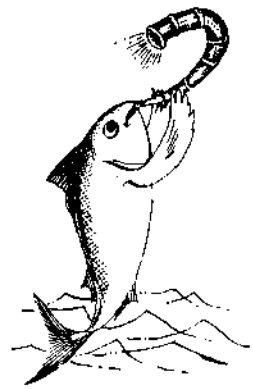
all that will remain of a once-great industry are the legends, the relics lovingly preserved and the stories of danger and adventure in remote waters, some of which are well brought out in this book.

Bacteria and mineral cycling. T. Fenchel and T. H. Blackburn. Academic Press, London, pp. 224, 1979.

This book describes the influences of bacterial metabolism on the chemical environment of the biosphere. The discussion of the energetics of bacterial processes serves as a general structure for most of the topics in the book. Within this basic frame work, two major aspects of bacterial metabolism are stressed. Firstly, the chemical evolution of the biosphere and secondly, the manner in which different element cycles interconnect in natural ecosystems. Appendices are included. It will be useful for the general microbiologists who want to find out about the ecological significance of micro-organisms and for the soil scientists and environmental engineers involved with microbiological ecosystems.

Dynamic analysis of off-shore structures. C. A. Brebbia and S. Walker. Newnes Butterworths, London, pp. 323, 1979.

This book brings together in one volume the theory relevant to the dynamic analysis of offshore structures, and describes systematically the methods of applying the theory. It is arranged in such a way that the various stages of analysis can be performed while following the text page by page. The fundamentals of probabilistic processes are explained and applied to the study of sea states. The methods of calculation of wave forces on offshore structures are examined with the essential hydrodynamics. The effects of currents and wind forces are also extensively discussed. The problems of fatigue and soil structure interaction are discussed.



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